



STRATHMORE BUSINESS SCHOOL

MASTER OF MANAGEMENT IN AGRIBUSINESS

END OF SEMESTER EXAMINATIONS

MMA 8104: QUANTITATIVE ANALYSIS FOR AGRIBUSINESS I

Date: Friday, 19th January 2018

Time: 3 hours

Instructions

1. This examination consists of **SIX** questions.
2. Answer question **ONE** and any other **FOUR** questions.

Question 1 (Compulsory) (20 Marks)

An invoice has names of the buyer and the seller and indicates what product or products have been delivered to the buyer, the date and the method of transportation, the prices, total sales figure, and terms of payment. A mail order, farmer A is interested in describing the size (in shillings) of the maize orders he received during the past fiscal year. To do so, the farmer randomly selected 100 invoices from the collection of all invoices written last year and recorded the 'total sale' figure listed on each. These figures rounded to the nearest thousand shillings are given below:

1	21	31	33	41	42	44	23	22	5
11	25	8	20	20	8	43	19	45	20
15	30	10	30	29	9	80	25	48	19
17	25	22	28	35	32	88	21	48	36
34	32	24	27	43	18	75	24	126	26
39	40	36	28	52	33	66	35	49	34
15	19	11	24	55	27	92	45	2	33
30	30	12	29	55	58	7	110	10	33
38	29	27	37	44	58	90	24	63	70
10	30	28	28	29	19	20	13	12	6

- a) Using the given data above,
- i Prepare a stem and leaf diagram using a leaf unit =1.0

(5 Marks)

ii Give one merit of representing the above data using stem and leaf over a histogram

(1 Mark)

- b) Suppose the *total sales* for two mail order farmers A and B on 100 invoices sampled from each of them, gave the following summary statistics:

Descriptive Statistics: Total sales farmer A, Total sales farmer B

Variable	Mean	SE Mean	StDev	Median	Range	Kurtosis
Total sales <u>farmer A</u>	33.42	2.25	22.45	29.00	125.00	3.64
Total sales farmer B	35.61	2.67	26.66	26.50	91.00	-0.93

Using the given data,

- (i) Comment on the skewness of the *total sales* for the two farmers. Which farmer has a better distribution of total sales during the past year (3 Marks)
- (ii) Suppose two more invoices were examined and their total sale figures, \$20 (in thousands) and \$250 (in thousands) were included in the data set for farmer A. Explain how this would affect the median and mean of the data set. (2 Marks)
- (iii) Determine the coefficient of variation for farmer A and farmer B. Hence, interpret your results. (3 Marks)
- c) Suppose a regression equation is defined by $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$ where $X_i, (i = 1, 2, 3, \dots, n)$ are independent random variables, and $\beta_i, (i = 1, 2, 3, \dots, n)$ are constants, Y is the response variable. Explain four assumptions about the error term ε of the model. (2 Marks)

A farmer would like to estimate weekly gross revenue (from his green house), Y as a function of television advertising (X_1) expenditure and newspaper advertising (X_2). The summary data in thousand dollars is given below;

Regression Analysis: WEEKLY GROSS Y versus TV ADVERT(X1) , NEWSPAPER ADVERT (X2) .

Predictor	Coef	SE Coef	T	P
Constant	83.230	1.574	52.88	0.000
TV ADVERT (X1)	2.2902	0.3041	7.53	0.001
NEWSPAPER ADVERT (X2)	1.3010	0.3207	4.06	0.010

S = 0.642587 R-Sq = 91.9% R-Sq(adj) = 88.7%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	2	23.435	11.718	28.38	0.002
Residual Error	5	2.065	0.413		
Total	7	25.500			

Required:

- (i) Write the multiple regression model with TV advert and Newspaper advert as independent variables **(1 Mark)**
- (ii) Briefly explain the meaning of R-sq above **(1 Mark)**
- (iii) Interpret the coefficients 83.230, 2.2902 and 1.3010 for the predictor, TV advert and
- (iv) Newspaper advert respectively. **(2 Marks)**

Question 2 (10 Marks)

- a) The demand equation for rice is $p = -3x + 25$, where p is the price in dollars and x is the number of kilograms sold in thousands. The cost function is $C(x) = 7x + 15$.
 - i) Find the corresponding revenue and profit functions **(1 Mark)**
 - ii) A rice farmer who has invested a reasonable amount of money and expects to make profit after some time. From the given information, will the farmer ever break even? **(3 Marks)**
- b) The cost of Nitrogenous fertilizers has been growing over time. In one leading Agrovet, the annual sales (in thousands of bags) of the fertilizer is expected to grow in accordance with function $f(t) = 0.18t^2 + 0.16t + 2.64$ per year, where t is measured in years. Determine the number of bags of the fertilizer which will be sold over the next 6 years. **(3 Marks)**
- c) A poultry farmer can sell 10,000 broilers in a month if he charges \$4 each. He also notices that if he raised the price by \$0.25, he sells 500 less broilers. How much each would he sell to make most revenue from his farm? **(3 Marks)**

Question 3 (10 Marks)

The Agriculture Cabinet Secretary in Kenya has been working to improve the motivation of coffee farmers. He predicted that he met his goal of improving coffee farmer's satisfaction from 65% to 80%. Farmers from four counties were asked if they were satisfied with the pay from coffee harvest. The results are shown in the following table:

	Nyeri	Kericho	Nandi	Muranga
Satisfied	12	38	5	8
Dissatisfied	7	19	3	1
Total	19	57	8	9

Use Chi-square to determine whether the results support or reject the Cabinet Secretary's prediction.

Question 4 (10 Marks)

- a) A farm manager reported the number of litres of Milk produced by 10 cows in 2015. She recorded the amount of milk as shown in the data below:

4376	5578	2717	4920	4495
4798	6446	4119	4237	3814

Use the given data to:

- i) Compute a point estimate of the mean production of milk per cow. **(2 Marks)**
- ii) Determine a point estimate of the standard deviation of the production of milk per cow **(4 Marks)**

- b) Hot Oven Bakery specialize in making party cakes. The management believes that cakes produced by Oven A on average take longer to be ready than those from Oven B. To test this belief, random samples of cakes produced by the two ovens were tested and yielded the results below.

Process	Sample size	Average cooking time	Standard Deviation in minutes of cooking
A	64	106	12
B	64	100	10

- i) Calculate the point estimate of the mean difference between cakes baked by the two ovens. **(1 Mark)**
- ii) Determine whether there is evidence at 5 % significance level that the management is correct in its belief using the critical value approach. **(6 Marks)**

Question 5 (10 Marks)

- a) A supplier gives beans to school A, B and C in bags of 5kg, 10 kg and 15 kg as shown below:

	5 kg	10 kg	15 kg
School A	50	100	30
School B	60	150	40
School C	80	200	70

The cost price of 5kg, 10kg and 15 kg bags are kshs. 1060, kshs. 1720 and kshs. 2250 respectively.

Form two matrices P and Q, hence find the total revenue the supplier gets from all the three schools. **(4 Marks)**

- b) The meteorological department claims that if today is sunny, tomorrow will be sunny 80% of the time. If today is cloudy, tomorrow will be cloudy 60% of the time. Farmers need to know prevailing conditions in order to dry their grains. Supposing today is sunny, what is the likelihood that it will be cloudy the day after tomorrow? **(6 Marks)**

Question 6 (10 marks)

There has been increasing campaigns for healthy eating in Africa from 2014 to 2016. Mrs. Osoro has taken advantage of this situation and increased the number of greenhouses on her farm, but with a

bias towards increasing the number of Capsicum crates of assorted colors. She has been recording the number of crates of capsicum in thousands for three years as shown in the table below:

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2014	20	30	39	60
2015	40	51	62	81
2016	50	64	74	95

Required:

- a) Find the seasonally adjusted indices for each quarter using the ratio to moving averages method. **(7 Marks)**
- b) From the data, the trend line for three years yields the equation $y = 21.9 + 5.17x$. Using this equation and the calculated seasonally adjusted indices in (a) above, find the expected number of crates in thousands for the 4th quarter of 2017? **(3 Marks)**